# Term Test

## kinematics

vectors - add, subtract using diagrams, cosine/sine law and components

$c^2 = a^2 + b^2 - 2ab\cos C$

$\sin A/a = \sin B/b = \sin C/c$

$v_y = v\sin\theta$ $v_x = v\cos\theta$

$\theta$ is the angle between x and v

## projectiles

$d_x = v_x t$

$d_y = 1/2gt^2 + v_{yi}t$ $v_{yi} = v\sin\theta$ $v_x = v\cos\theta$

$v_{yf} = gt + v_{yi}$

## Dynamics - Newton's 3 Laws

$F_{net} = ma = \Sigma F$ - vector addition of all forces

slopes - $F_{g||} = mg\sin\theta$ $F_{g\perp} = mg\cos\theta$

Circular motion

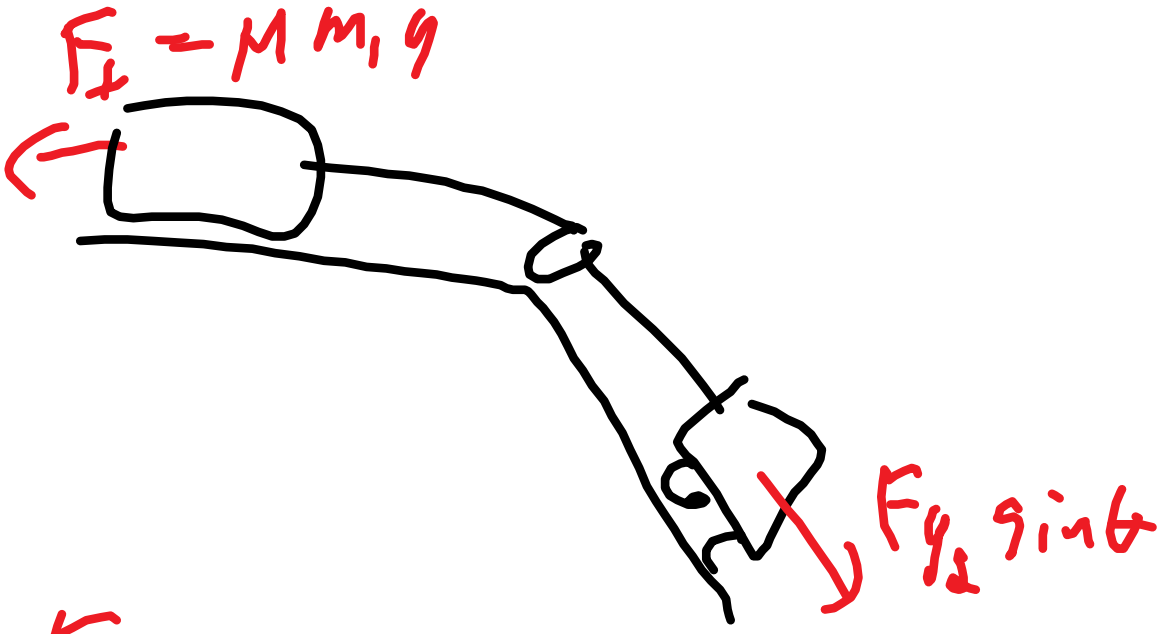
$F_c=mv^2/r = m\ 4\pi^2r/T^2 = ma_c$

$F_c$ is $F_{net}$ for uniform circular motion

$F_g=GMm/r^2$  $G=6.67x10^{-11}Nm^2/kg^2$

$F_c=F_g$ for orbits

Short Answer Test




$F_{net} = m_1 a = m_2 g \sin\theta - \mu m_1 g$

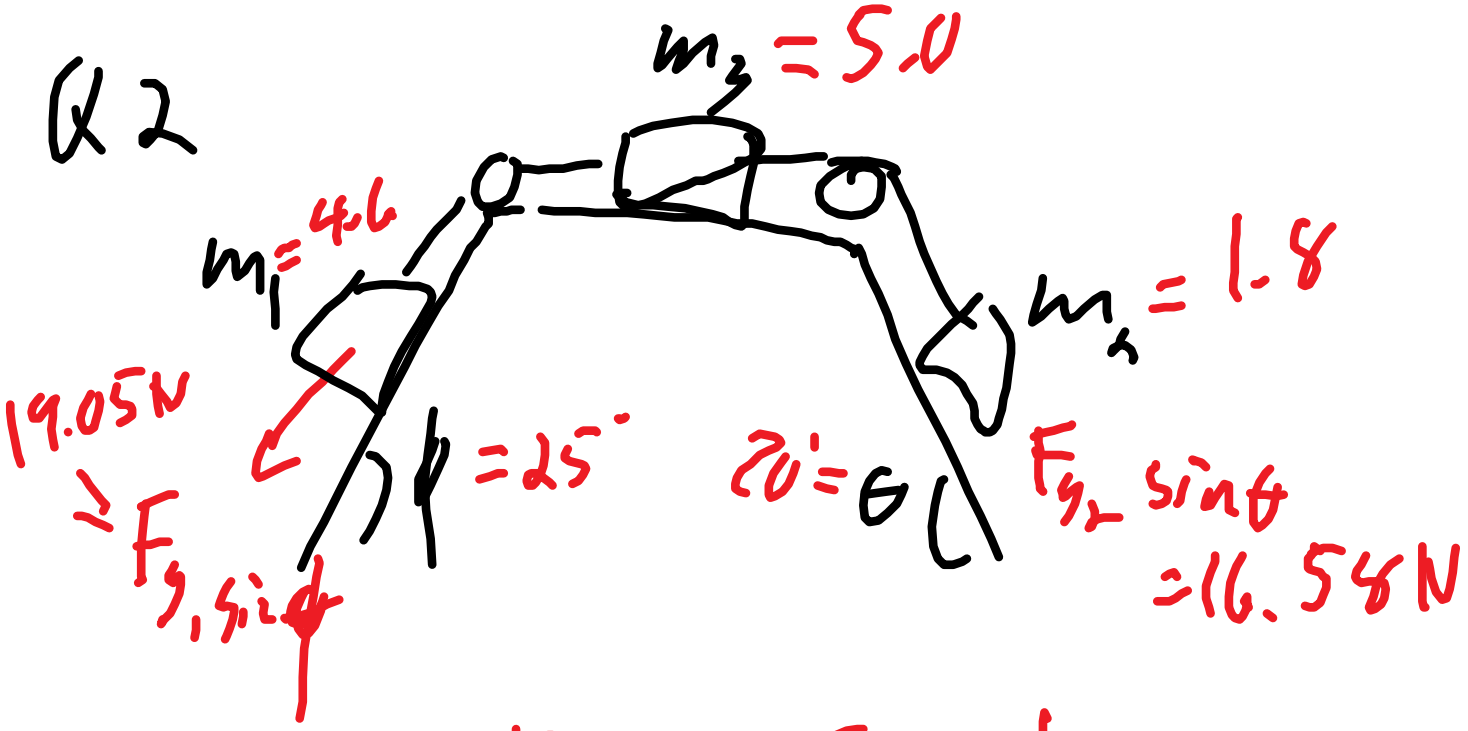
$a = \dfrac{15\,kg\ 9.8\,m/s^2 \sin 4^\circ - 0.23(10)(9.8}{}$

v1

15 + 10

$a = 3.0\ m/s^2$ or

Q2




$F_{net} = F_{g_2}\sin\theta - F_{g_1}\sin\phi = (m_1 + m_2 + m_3)a$

$19.05 - 16.58 = 11.4\,a$

$a = 0.22\ m/s^2$ up slope

b)


$m_2 a = F_T - F_{g\sin\theta}$


$F_f = 17N$

Art + Bill both push sideways with same force but Art pushes down, increasing Normal force. Since $F_f = \mu F_N$ friction increased.
Bill decreases $F_N$ + $F_f$.

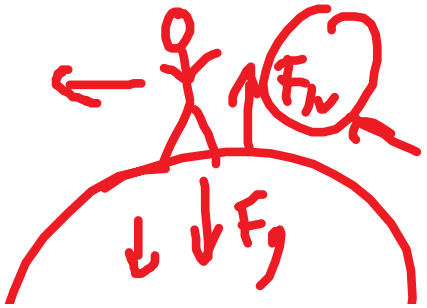
Q4


$F_t - F_g = F_c$

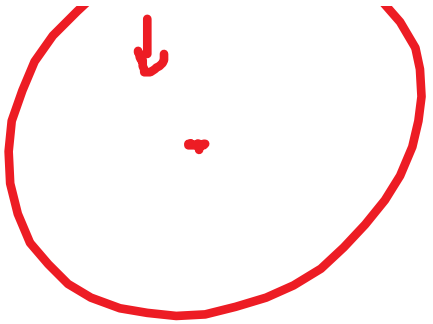
$1400 - \frac{85(9.8)}{16} = \frac{85 v^2}{16}$

$v = 10.3 m/s$

Q5




apparent weight



$$F_c = F_g - F_N$$

$$F_N = F_g - F_c$$

$$F_N = 200N - \frac{\left(\frac{200}{9.8}\right) 465^2}{1.27 \times 10^7 / 2}$$

$$= \boxed{199\,N}$$

Bonus $m_1 a_c = m_2 a_c$

$$m_1 \frac{4\pi^2 r_1}{T^2} = m_2 \frac{4\pi^2 r_2}{T^2}$$

$$T = T$$

$$m_1 r_1 = m_2 r_2$$

$$\frac{m_1}{m_2} = \frac{r_2}{r_1}$$